The Citrus Industry
EXCLUSIVE SPECIALIZED CITRUS PUBLICATION
Issued Monthly
Representative of every interest
Representing no special interest

Publication office at Bartow, Florida. Entered as second class matter February 16th, 1920, at the post office at Tampa, Florida, under the act of March 3, 1879. Entered as second class matter June 19, 1933, at the post office at Bartow Florida, under act of March 3, 1879.

Blessings And Problems Both Result Of Heavy Rains

WILL YOU HAVE A GOOD CROP NEXT YEAR, AND WILL YOUR CROP THIS YEAR BE OF PROFITABLE QUALITY?

By The "Observer"

During June and July most of the citrus belt experienced unusually heavy rains. In a good many sections from twenty-five to thirty inches of water fell in a period of a few weeks.

While rain was most welcome following a quite serious drought that persisted during the spring months, the total amount of rain that fell naturally tends to wash or leach many soluble plant foods from the soil.

Under normal conditions, groves look their best during the rainy season. Observations made on extended travel over the citrus belt indicate that a fairly large percentage of groves do not look as good now as they did in June. This is believed due in part to leaching of plant foods by excessive rains.

This condition is not to be wondered at in view of facts prevailing during the past year or so. Last season the state had the largest crop in its history. This meant a tremendous strain on the trees and demanded unusually large amounts of plant food.

In spite of this heavy crop, groves as a whole went into last fall in the pink of condition and stayed in good condition through the winter. This was undoubtedly the result of proper fertilization generally up to that time. In fact, the almost universal good grove condition that existed last fall and winter, in spite of heavy crops, is a remarkable tribute to research workers who have in recent years developed much worth while information on feeding citrus trees and caring for the soil. It is of equal tribute to the fertilizer industry, which necessarily manufactured and sold the right things. As usual the key man in this picture was John Q. Grower who bought and used the right thing in sufficient quantity.

However, the immense crop of last season was a great strain on the trees, and according to estimates recently made and general observations, there is another large crop (with some exceptions) on the trees at this time. A brief glimpse into history shows that two consecutive heavy crops are such an enormous drain on the trees and on the soil that they pull groves down and usually result in poor tree condition and very little crop the third season.

This fact has been complicated by poor returns for much fruit shipped during this past season, which resulted in many growers economizing stringently in their fertilization and general grove programs. Much of this was due to necessity, while probably part of it was due to general mental attitude of growers, and probably to a lesser extent to drought in winter and spring.

Regardless of what the reasons were, the fact remains that many groves are breaking in condition rapidly at a season of the year when they should be in their prime. A trip through the citrus belt will convince any experienced man that supplementary feeding seems a necessity this summer if trees are expected to go through September in passable condition and be ready to go into the winter in good shape to bear a satisfactory crop next year. Based on experience of previous years, coupled with the condition of many groves at this time, it is felt that a great many growers will be shocked at the condition of their groves in September or October unless supplementary fertilizing is done now.

Experienced citrus men say that groves which break in condition badly in late summer or early fall cannot be expected to bear normal crops the coming year.

The excessive rains have also played havoc with spray and dust programs due to the fact that sulphur simply cannot stay on the trees long under rainy conditions such as have persisted generally in June and July. Based on information reported in various bulletins from time to time concerning the efficiency of sulphur sprays and dusts after eight or ten inches of rainfall, it is no wonder that many growers are finding it

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Some Results Of Studies On Citrus Production Costs

BY R. H. HOWARD
ASSISTANT ECONOMIST, FLORIDA AGRICULTURAL EXPERIMENT STATION

When the net returns per box were two dollars and better, growers had little difficulty in showing a return or profit on their groves, regardless of inefficiencies. However, in recent years with declining prices as the result of larger crops, groves having comparatively better natural advantages and efficient and economical production practices applied, are still able to operate at a profit.

Generally speaking, a grove having comparatively less natural advantages than the average may be classified as marginal. Many of the marginal citrus groves in Florida have competed in recent years in spite of natural disadvantages because of more efficient and economical production by some grove operators. Although, after maximum efficiency is acquired, according to all known economical and profitable practices, and cost of production becomes greater per box than the price of fruit, the marginal groves will undoubtedly be at a disadvantage. According to the grove records summarized by the Agricultural Extension Service since 1930, many groves might be termed as submarginal as far as returns are concerned.

Disregarding efficient or inefficient practices from the 1930-31 through the 1936-37 crop years, groves that received the best care, as measured by amount of money spent, showed the greatest net returns per acre. However, the average price of citrus fruits during this period probably will about double the prices received for the following crops marketed. With this large percentage reduction in prices received and the income being less than the total cost of production, the more spent for care in production, the greater the losses are for many of the marginal and non-irrigated groves.

Due to variations in natural advantages, time of marketing, yield, costs incurred for care, and price received, the fruit returns from many groves exceed cash cost of production. Should prices remain relatively low for several years, many sub-marginal and unprofitable groves will likely be neglected.

It is obvious that many growers will be looking for every means of reducing cost of production in an attempt to cope with the situation. With this in view, let us see how and where growers might economize in the care of groves during a low price level, according to the results of our grove records.

First, the largest single item of cost in growing citrus on the sandy soils is for fertilizer which affects yield more than any other item of cultural care. In view of the relatively low prices of citrus and income from groves, it would seem that if a reduction in fertilizer must be made, phosphoric acid, potash, and perhaps some of the less common plant food elements could be reduced with less detriment to the average grove than a proportional reduction in nitrogen. By maintaining the nitrogen plant food, if no deficiency is apparent, yield of fruit can be fairly well maintained for the immediate future. During the crop year 1931-32, when prices of fruit were comparatively low and the average grove failed to show a net return for that crop, many growers in Lake County resorted to such a program as outlined above. The following year, according to the records, net returns for the groves in Lake County were greater than the average of all other groves in the interior part of the state. This method of economizing in fertilization enabled many growers to maintain the trees, which should be of first consideration during an unprofitable year. A grove consisting of full bearing trees represents years of care and expense and if neglected, severe set-back in its productiveness may result. If a grove is so situated as to have comparative natural advantages over most groves and the owner is financially able, he would probably be justified in following the normal fertilization program.

Second in importance, in the most recent analysis of factors affecting returns from a citrus grove in Florida, irrigation was found to increase returns through increased yields. However, returns from the additional expenditure for irrigating groves also depends largely on the price of fruit. Adequate water for profitable citrus production at an average price of $1.02 per box for oranges and $0.52 per box for grapefruit (simple average from 1930-31 through 1936-37 marketing seasons) paid large dividends for the expenditure. At the present prices of both fruits, the expense necessary to irrigate may not be justifiable unless severe drouth occurs. Then this care may be given more for the sake of the trees than for immediate fruit production. Net returns to owners from irrigated groves, for the crop marketed last year, averaged $.12 while non-irrigated groves showed a loss of $0.08 per box. Although, when the charge for grove valuation is excluded from the cost, the returns for interest and owner's supervision was $0.29 for the irrigated and $0.14 per box for non-irrigated groves.

Third, according to a study of the influence of cultivation upon grove yields and returns, it was revealed that little or no immediate benefit results from the expenditure. Although, over a period of years some cultivation may be justifiable. In view of the outlook for the citrus industry, indications are that many growers might well reduce the amount of cultivation to a minimum, thereby reducing the cost for this operation.

The expense of hoeing bearing trees may also be dispensed with in order to reduce the cost of production. It is uneconomical to hoe bearing trees, with modern and efficient machinery available for tilling and disposing of cover crops. Indications are that hoeing bearing trees increases the cost of production with no increase in yield of fruit.

Fourth, the expense of insect and disease control measures could probably be reduced some by close inspection and either spraying or dusting at the opportune time before serious damage occurs. At the present prices received for number one bright fruit, the necessary expense to obtain a high percent of this grade cannot be economically justified. It would appear logical and profitable for the average grower to allow a higher percent of infestation to exist before going to the expense of insect control, particularly for the rust mite infestation. The scale insects, most of which prey upon parts of the tree, may cause considerable damage and future productiveness may

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A Rapid Laboratory Method For The Determination Of Exchangeable Magnesium In Soils

By MICHAEL PEECH, C. M. TIDWELL and M. L. BROWN

CITRUS EXPERIMENT STATION, LAKE ALFRED, FLORIDA, AT MEETING OF FLORIDA STATE HORTICULTURAL SOCIETY

The investigations reported by Bahrt (1), Bahrt and Hughes (2), Tait (7), Bryan and DeBusk (3), and Fudge (5), as well as the experiments now in progress at the Citrus Experiment Station have shown rather conclusively that a certain type of leaf chlorosis in citrus in Florida, commonly referred to as bronzing, is caused by a magnesium deficiency and that this condition may be corrected by application of dolomite limestone or magnesium sulfate (Emjeo). This type of bronzing is similar to "types A and B" originally described by Bahrt and Hughes (2) and has been since specifically attributed by Camp (4) and Fudge (5) to a magnesium deficiency. While the use of soluble magnesium in the winter or spring will control bronzing during the succeeding fall, the response to dolomite is not generally noted in the tree condition until the second season. Unpublished work at the Citrus Experiment Station would indicate, however, that magnesium sulfate increases the exchangeable-magnesium content only slightly when applied on acid soils unless the soil acidity is corrected. Hence some form of basic material, such as dolomitic limestone, is recommended on acid soils in conjunction with soluble forms of magnesium to provide an immediate supply of available magnesium and at the same time to build up the amount of exchangeable magnesium in the soil. The rate of reaction of dolomite with the soil may be expected to be markedly affected by the depth of incorporation, soil reaction (pH), moisture conditions, fertilizer practice, and other factors. It was thought desirable, therefore, to develop a rapid laboratory method by which the amount of the readily available magnesium present in the soil at any time could be ascertained with a fair degree of accuracy and which could be used in predicting the need for magnesium fertilization early in the season before the appearance of the usual symptoms of magnesium deficiency. From the foregoing discussion it should be obvious that if the method is to be used as a measure of the immediate supply of the readily available magnesium in the soil, the extracting solution employed must necessarily extract only the exchangeable and the water-soluble magnesium without bringing into solution undue amounts of magnesium from free or unreacted dolomite that may be present. After a preliminary study of the solubility of dolomite in several different extracting solutions that are commonly used, a rapid method for the determination of exchangeable magnesium was finally worked out and its efficacy in predicting magnesium deficiency was tested in a survey made of 510 commercial groves. The method for making the magnesium test is presented here in detail for the benefit of those interested in soil testing, together with a preliminary report on some of the correlations established between the occurrence of bronzing and the amount of exchangeable magnesium in the soil as determined by this method.

Solubility of Dolomite in Different Extracting Solutions

Considerable time was spent in finding a suitable extracting solution that would extract the exchangeable magnesium without bringing into solution undue amounts of free or unreacted dolomite. The following extracting solutions were studied: 1 N ammonium acetate, pH 7.0; 1 N sodium acetate, pH 7.0; 1 N sodium chloride; and the "Universal" extracting solution, sodium acetate buffered at pH 4.8 as proposed by Morgan (6). Lack of space will not permit a detailed discussion of the results obtained with the above extracting solutions under various conditions. Some of the results are briefly summarized below.

The following experiment was carried out to determine the solubility of dolomite in the extracting solutions listed above. Dolomite was added to each of the extracting solutions in the amounts that would be equivalent to 1000, 2000, and 4000 pounds per acre under actual conditions of the test to be described later, and the amount of magnesium brought into solution was determined in the filtered extracts. The amounts of magnesium dissolved, expressed in pounds per acre, are shown in Table 1.

The amount of magnesium brought into solution by the "Universal" extracting solution when dolomite was added in the amounts equivalent to 2000 and 4000 pounds per acre would exceed the amount of magnesium present in the exchangeable form in the majority of light sandy grove soils.

In another series of experiments, varying amounts of dolomite were added to soils at different pH values and then extracted with each of the above solutions. The results were somewhat different. In the case of acid soils (below pH 5.0) to which dolomite was added at the rate of one-half, one, and two tons per acre, the sodium chloride solution dissolv-

TABLE 1

Solubility of Dolomite in Different Extracting Solutions

Extracting Solution	Amount of dolomite added (lbs. per a.) 1000	2000	4000
	Mg dissolved lbs. per acre	Mg dissolved lbs. per acre	Mg dissolved lbs. per acre
1 N ammonium acetate, pH 7.0	12	21	36
1 N sodium acetate, pH 7.0	9	17	30
1 N sodium chloride	3	8	10
"Universal" extracting solution-Sodium acetate, pH 4.8	24	60	102

ed a larger amount of dolomite than either ammonium acetate or sodium acetate at pH 7.0. The higher solubility of dolomite in the sodium chloride solution under such conditions is due to the formation of strong acid (HC1) as a result of the replacement of the absorbed hydrogen by sodium ions. When the same amounts of dolomite were added to soils with pH values above 5.5, sodium chloride, sodium acetate (pH 7.0), and ammonium acetate (pH 7.0), gave comparable results.

From the standpoint of the amount of organic matter dissolved by the different extracting solutions, sodium chloride possesses an advantage over sodium acetate and ammonium acetate. The sodium chloride extracts are sufficiently clear to eliminate the necessity for evaporation and subsequent treatment in the destruction of organic matter. Hence the test can be performed directly on the extracts immediately after filtration. On the other hand because of the high pH values of the sodium acetate and ammonium acetate extracts, a considerable amount of organic matter is brought into solution which must be removed before making the magnesium test. In actual routine work, however, where a large number of tests are made from day to day, this extra step in the procedure takes very little time.

Ammonium acetate was finally chosen as the extracting solution in this study since it was found to measure with a fair degree of accuracy the immediate supply of exchangeable magnesium in the soil regardless of its pH value without bringing into solution undue amounts of magnesium from free or unreacted dolomite even when applied at the rate of two tons per acre immediately prior to the taking of soil samples. In addition, ammonium acetate was already in use in the determination of exchange capacity and the exchangeable bases, thus making the results presented here comparable with those published to date.

Outline of the Method

Reagents:

1. Extracting solution, ammonium acetate, 1 N, pH 7.0.

This reagent can be prepared more accurately from concentrated ammonium hydroxide and acetic acid than from the salt of ammonium acetate. To about 500 ml. of water in a one-litre volumetric flask add 70 ml. of concentrated ammonium hydroxide, sp. gr. 0.9, and 58 ml. of acetic acid, 99.5 per cent. After cooling, dilute to one-litre mark, mix thoroughly and adjust the pH to exactly pH 7.0 using brom thymol blue as an indicator, or preferably electrometrically, by the addition of more ammonium hydroxide or acetic acid. If many determinations are to be made it is best to prepare 18 litres of this solution at one time in a 5-gallon bottle.

2. Ammonium oxalate, 1.5 per cent.

Dissolve 15 grams of (NH4)2C2-O4-H2O in a litre of water. Adjust to approximately pH 4.3 by the addition of hydrochloric acid. About 1.5 ml. conc. HC1 per litre of solution is usually sufficient.

3. Hydrogen peroxide, 6 per cent.

Mix one volume of 30 per cent hydrogen peroxide with four volumes of water. Hydrogen peroxide, 30%, should be handled with caution, as it produces serious burns when allowed to come in contact with the skin.

4. Hydrochloric acid (1+3).

Mix one volume of concentrated HC1 with three volumes of water.

5. Titan yellow, 0.01 per cent.

Dissolve ten milligrams of Titan yellow in 100 ml. of distilled water. Since this reagent deteriorates with time, it should be freshly prepared every three or four days, or preferably every day for best results. For this reason the same batch of Titan yellow solution should be used in both the standards and the unknown solutions in making the test. Preparations of Titan yellow purchased from the British Drug Houses, Ltd., London, and Dr. G. Grubler & Co., Germany have been found equally satisfactory. Clayton yellow is substituted by some chemical houses for Titan yellow; however, only the latter is recommended because of its greater sensitivity at lower concentrations of magnesium.

6. Starch solution, 0.5 per cent.

This solution is prepared from a reagent grade of soluble starch. Place approximately 0.5 grams of starch in a beaker, add a few drops of water, and grind into a paste by means of a glass stirring rod. Pour slowly 100 ml. of boiling water, stirring constantly until all of the starch has dissolved. Filter the solution while hot through a filter paper, Whatman No. 30 (or similar grade). Cool before use by placing in a dish of cold water. A good grade of soluble starch should give a perfectly clear solution.

7. Sodium hydroxide, 3.2 per cent.

Dissolve 16 grams of sodium hydroxide in 500 ml. of water.

8. Standard magnesium solution.

Stock solution. Prepare a stock solution by dissolving 1.014 gm. of MgSO4-7H2O in one litre of water. Mix thoroughly by shaking. To preserve, add 1 ml. of chloroform, and shake vigorously again. This solution contains 0.1 mg. of magnesium per ml. and is too concentrated for use.

Standard solution. Dilute 50 ml. of the above stock solution to 500 ml., add 1 ml. of chloroform and shake vigorously. This solution contains .01 mg. of magnesium per ml. and is used in making up the standards.

Procedure

Weigh out 5 gm. of soil into a Pyrex test tube (25x150 mm.), add 25 ml. of 1 N ammonium acetate and shake for 30 minutes. Filter through a filter paper, Whatman No. 30 (or similar grade) into a test tube (15x-125 mm.) calibrated to deliver 12 ml., discarding the first 3 to 5 ml. of the extract. Transfer 12 ml. of the extract into a 50 ml. beaker and evaporate to dryness on a hot plate. Remove the beakers from the hot plate as soon as all of the ammonium acetate has evaporated since prolonged heating at this stage makes the subsequent destruction of organic matter more difficult. Treat the residue with 2 ml. of 6 per cent hydrogen peroxide and digest at room temperature for one hour, or preferably over night. Evaporate to dryness on a hot plate, cool, add 1 ml. of hydrochloric acid, rotate to wet the side of the beaker, and evaporate to dryness again. Cool, add 12 ml. of water from a burette, and stir with a rubber policeman to effect the solution of salts. Since calcium interferes in this test, it is removed by precipitation as calcium oxalate. Introduce a 10 ml. aliquot of this solution into a test tube (15x125 mm.). The test tube may be calibrated to contain 10 ml. in which case the solution is poured directly from the beaker into the test tube to the 10 ml. mark thus expediting the work. Now add 2 ml. of ammonium oxalate, mix the contents thoroughly, and allow to stand for at least one hour in order to allow the calcium oxalate precipitate to settle.

When the precipitate has settled to the bottom of the test tube, pipette an aliquot (1, 2, 3, or 5 ml., depending upon the amount of magnesium present and the accuracy desired) of the clear supernatant liquid into a vial (65x19 mm.). In the determinations reported here, an aliquot corresponding to the 5 ml. aliquot shown in Table 2 was used, but 3 and 2 ml aliquots are recommended for general routine work. Since ammonium oxalate slightly affects the quality as well as the intensity of the color developed in the test, it must be added to the standards in approximately the same amount that is present in the test solution. If the standards are prepared for use with 3 ml. aliquots, 0.5 ml. of ammonium

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THE COMING CITRUS CROP

Latest estimates of the forthcoming citrus crop, based upon condition reports of the Federal Department of Agriculture, indicate that the orange crop will be essentially the same as last season, baring unforseen curtailment by reason of weather conditions during the remainder of the maturing season.

Grapefruit conditions, however, show a marked decline from the same period a year ago, and present indications are that the grapefruit yield will not be in excess of two-thirds the enormous yield of last season.

Tangerine conditions also are well below that of a year ago.

Based upon these condition reports, we may expect another season of surplus production of oranges, not only in Florida but in all American orange producing sections. With the anticipated grade and size requirements for out-of-state shipments, it behooves growers to do everything still possible to produce fruit which will meet these requirements.

As to grapefruit, even with two-thirds of last year's record-breaking yield forecast, there will be ample supplies to meet the nation's consuming capacity.

Good fruit only may be expected to bring profitable prices and only the very best of fruit may hope to bring a premium. Every possible step should be taken to see that nothing but fruit of high quality and fine appearance is allowed to go to market. There should be no repetition of the practice of rushing unpalatable fruit to Northern markets — attempting to "beat the gun" by the shipment of immature fruit in the hope of getting the "high dollar" at the expense of later shipments.

Every grower and shipper should join with state and federal inspection officials in seeing that all maturity requirements are strictly enforced. Every grower, in addition, should protect his own interests by doing everything possible to produce the highest possible quality of fruit and to see that none of inferior quality is offered to the trade. Strict adherence to such a policy will result in a better bank balance at the end of the season.

MAYO RIGHT — AS USUAL

When, on April 30, Commissioner of Agriculture Mayo's Citrus Inspection Bureau issued a statement estimating that Florida citrus groves still had 5,519,000 boxes of oranges on the trees, a great cry went up that the estimate was sadly out of plumb. Other estimates were quickly forthcoming, most of them asserting that the estimate of the Inspection Bureau was at least double the amount of fruit still remaining. Mayo and his men, it was alleged, were merely guessing.

Up to July 4th, a total of 5,582,574 boxes had been shipped following the Inspection Inspection Bureau's estimate, exceeding that estimate by some 65,000 boxes — and the pickers were then, and still are, busy picking Valencias. Indeed, at this writing, the latter days of July, late Valencias are still going to market in quantities.

Apparently some of the criticism directed at the estimate was in reality an effort to discredit Commissioner Mayo. If so, it has reacted upon the critics. Commissioner Mayo's splendid work in enforcing inspection and other legislation designed to benefit the growers is too well known and too highly appreciated to be affected by unjust and unfounded criticism.

Naturally, Mr. Mayo and the officials of the Inspection Bureau are gratified at the confirmation of the accuracy of their estimate. Instead of over-estimating the quantity of fruit still on the trees they actually underestimated it. Nothing is to be gained by trying to hide the facts, and Commissioner Mayo is to be commended for the accuracy of his estimate.

HEAVY RAINS BRING PROBLEMS

As noted by "Observer" elsewhere in this issue, the heavy rains of the past two months, while proving a blessing to citrus growers in some respects, have at the same time created problems which must be met.

With twenty, twenty-five and even thirty inches of rainfall in some localities during June and July, there has been a consequent heavy leaching of fertilizers. Plant food which trees now heavily laden and which bore a record crop last season are sadly needing has been washed away, leaving the trees inadequately supplied at a time when plant food is required to properly mature the coming crop.

The same condition prevails in regard to sprays and dusts which have been washed away by the heavy rains, and many growers are finding that additional applications are needed to protect their trees and their fruit from the ravages of citrus pests.

Many growers find that as a result of the leaching of fertilizers their trees are showing a decline at a time when normally they are at their best. In some groves additional applications of fertilizer have been made; in others they are badly needed if the present crop is to be matured at its best and the trees preserved for future crops.

Many growers, by reason of unsatisfactory prices for the fruit last year, have economized on fertilizer and other grove practices beyond the margin of safety, and in such groves the need for additional care and protection at this time is glaringly apparent.

If anything is to be done to assure orderly marketing and consequent profit to the grower in the approaching shipping season, it is high time that steps to that end be taken at once.

Pointers On Irrigation . . .

BY FRAZIER ROGERS
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Water is most often the limiting factor in crop production. Irrigation is not confined to arid areas where nature does not supply annually enough water for growth of crops, but is practiced, to some extent, in practically every state in the Union.

In Florida our annual rainfall of approximately sixty inches would be sufficient to grow crops without additional water if it would only fall at the proper time. However, the right quantity for Mr. A. would not necessarily be the same as that for Mr. B., even though they are neighbors but doing different types of farming. One may be a citrus grower, the other a truck crop farmer.

On the average, more than half of Florida's annual rainfall comes during our so-called rainy season; the last two weeks in May, June, and the first two weeks in July. Our truck crops are grown principally in winter and severe losses may be prevented by irrigation. The blooming period for citrus is February and March, a time when the soil moisture is quite likely to be low and thereby reduce the amount of fruit that is actually set. This is not the case every year, but it occurs with sufficient frequency to cause those who do not care to take the gamble to equip their groves with an irrigation system, reducing the uncertainty of a crop upon which much money has been spent. Let us think of it as an insurance against heavy losses in unfavorable years, when prices are best, due to unfavorable conditions during the growing period.

With this introduction, let us consider some of the main features of the three principal types of irrigation systems in use in Florida, namely; spray, surface and sub-surface. In the spray system the water is forced through nozzles which are either stationary or movable at a comparatively high pressure which breaks it up into particles varying in size from a fine mist to large drops, depending upon the size of the opening in the nozzle and the pressure used. This system is usually more efficient than other systems, but, unfortunately, it usually costs more. It takes power to force water through pipes. Pipes that are small require more power to force the same quantity of water through than larger pipes; of course, there is an economic limit as to the size of pipe for a definite quantity of water to be pumped. It is a question of interest on the investment on the one hand and lower operating cost on the other. Before deciding on the proper sizes of piping to use, a competent engineer should be consulted, for many irrigation plants have been installed which are too small and makes the operating cost excessive. Every pound pressure you pump against is the equivalent of raising that quantity of water 2.4 feet vertically. This system finds its principal use where plants to be irrigated have a low water demand, where efficient use of water is necessary, and where other systems are not practical. A large part of the irrigated truck crop area of Florida uses some form of this system.

Surface irrigation finds the greatest use where the water does not have to be raised to any great height, and the water demand of the crop is heavy. Both citrus and truck crops are watered by surface systems. In some areas the water is run through supply ditches into distributing furrows, while in the more open or porus soils the loss through percolation is too great and conductors other than ditches must be provided. Usually, sheet metal piping or porus hose is used as a means of distributing the water when this system is used. Our many fresh water lakes furnish an abundant supply of water for irrigation purposes, and it is only necessary to raise it a few feet due to the high level. Portable pumping plants are in use in great numbers and have been very satisfactory.

Sub-irrigation is the application of the water below the surface of the soil. Practically, it is raising the water table to a height where water will travel into the root zone of plants by capillary action. This type of irrigation cannot be used in all parts of the state with equal success because of the special soil and water conditions that must be met. For this system to be satisfactory there must be an impervious layer not greater than five feet below the surface or there will be too great a loss of water by percolation. An abundant supply of water that can be had at a very low cost is essential. Artesian wells furnish a great part of the water used in sub-irrigation. The land must be quite level so that the soil will not be over irrigated in one place and under irrigated in another. The soil must be open or porus to permit the passage of water through it. The soil must be well drained.

The supply lines are usually made of bell and spigot terra cotta pipe. The distributing laterals are made by using ordinary farm drain tile, three or four inches in diameter and twelve inches in length. The supply lines are placed on the higher level than the laterals. The laterals are spaced from ten to twenty-feet apart and are given a fall of from one to two inches per hundred (100) feet. Where each lateral enters the supply line, a supply pocket is provided to control the water in each line. At the end of each lateral a stop pocket is provided to prevent the water from passing through the tile line, forcing it out through the joints of the tile into the soil. Whenever drainage becomes necessary the nipples are removed from the stop pockets, thereby turning the irrigation system into a tile drainage system.

BLESSINGS AND PROBLEMS, BOTH RESULTS OF HEAVY RAINS

(Continued from page 4)

necessary to make one or more extra applications of sulphur spray or dust this season.

In talking with experts and caretakers, the observer has learned that the above conditions are not realized by many growers as existing now, because normally the grower expects his trees to be in the pink of condition at this season, and in many cases he has not checked over his grove to observe effects of excessive rainfall.

With the double-heavy crop strain, coupled with excessive leaching due to heavy rains, it looks to the observer as if many groves are doing to be in bad shape in the next two or three months and their owners badly disappointed in next years crop unless something is done in many cases. Incidentally, the almost definite assurance of a grade and size control over this season's crop seems to warrant growers taking every possible precaution to see that the fruit now on the trees can be sold to advantage this coming shipping season.

A RAPID LABORATORY METHOD FOR THE DETERMINATION OF EXCHANGEABLE MAGNESIUM IN SOILS

(Continued from page 7)

oxalate is added to each of the standards. In case it is necessary to repeat the determination on a smaller aliquot. the concentration of ammonium oxalate is adjusted by adding the proper amount of ammonium oxalate and making up to a volume of 5 ml. as shown below. The amounts of ammonium oxalate to be added to the aliquots as shown are based on the 3 ml. aliquot which contains 0.5 ml. of ammonium oxalate.

Aliquot taken (ml.)	Ml. of ammonium oxalate to be added to the aliquot	Ml. of water to make up to 5 ml.
3	None	2.0
2	0.2	2.8
1	0.3	3.2

After making the aliquot to volume (5 ml.), add 3 ml. of starch solution, 1 ml. of Titan yellow, and 1 ml. of sodium hydroxide in the order named, shaking after each addition. Do not allow the starch and the Titan yellow to stand in contact with the test solution for any length of time before the addition of sodium hydroxide. Mix thorougly and compare the color with a series of standards prepared at the same time according to the direction given in Table 3. Due to some fading of colors with time, the comparisons should be made within two hours or preferably as soon as possible after the colors are developed. In making the comparisons the test solution is held between two nearest standards and viewed from the top of the vial over a white sheet of paper. The readings are recorded in terms of the standard number. If a perfect match is obtained with standard No. 4 using a 3 ml. aliquot, the reading is recorded as 4, and is equivalent to 30 pounds of magnesium per acre as given in Table 2. Should the color match be obtained half way between standards 4 and 5, the reading is recorded as 4.5 and is equal to 35 pounds of magnesium using a 3 ml. aliquot, and 52 pounds in the case of a 2 ml. aliquot. Ordinarily the test is performed on a 3 ml. aliquot and repeated using a 2 ml. aliquot if the soil contains more than 60 pounds of magnesium per acre.

TABLE 2
Table for converting the readings in terms of standard no. into pounds of magnesium per acre-six-inches of soil

Reading in terms of standard no.	Magnesium (Mg) in pounds per acre Aliquot taken			
	1 ml.	2 ml.	3 ml.	5 ml.
1	0	0	0	0
2	30	15	10	6
3	60	30	20	12
4	90	45	30	18
5	120	60	40	24
6	180	90	60	36
7	300	150	100	60
8	600	300	200	120

A Correlation Between the Occurrence of Bronzing and the Amount of Magnesium as Determined by the Proposed Method

In the fall of 1938, during the months of October and November when the symptoms of magnesium deficiency are most prevalent, a survey was made of 519 commercial groves in an effort to correlate the occurrance of bronzing with the amount of magnesium in the soil as determined by the method just described. Of the 519 groves examined, 274 consisted of seedy grapefruit, 104 of Pineapple oranges, and 141 of Valencia oranges. This study was confined only to the seedy varieties of grapefruit since they have a high magnesium requirement and are especially susceptible to bronzing as shown by Fudge (5). In order to eliminate the effects of cropping on the amount of bronzing, only those grapefruit and orange groves were selected which carried a fairly uniform and heavy crop. Nearly all of the groves were on rough lemon stock and from 15 to 25 years old. The amount and extent of bronzing was carefully noted and recorded as "none", "light", "medium", or "severe".

In taking the soil samples about twenty borings made to the depth of the surface layer (usually 0-6 inches) were composited for each sample. The samples were brought to the laboratory, air dried, passed through a 2 mm. sieve and thoroughly mixed prior to the determination of magnesium and pH. The soils were arbitrarily divided into three groups on the basis of the organic matter content which was roughly estimated by comparison with samples of known organic matter content. The approximate percentages of organic matter, and the exchange capacity as well as the number of groves found within each group are given in Table 4. Out of the total number of 519 groves, 407 were located in Norfolk soils, 91 on Blanton soils, 16 on Eustis soils, 1 on Lakewood soil, 3 on Portsmouth soil, and 1 on Leon soil.

In the following discussion of the correlation between the amount of exchangeable magnesium in the soil and the occurrence of bronzing, no distinction will be made between "light", "medium", and "severe" bronzing, and the groves will be referred to as either bronzed or free from bronzing. In the case of "light" bronzing, only an occasional bronzed leaf could be noticed on limbs heavily loaded with fruit. Since in actual practice this amount of bronzing would hardly be recognized, groves that showed "none" to "light" bronzing will be considered as being commercially free from bronzing. In order to further simplify the presentation of the data, groves that showed "medium" to "severe" bronzing

TABLE 3
Preparation of Magnesium Standards

No.	ml. standard magnesium solution (.01 mg. magnesium per ml.)	ml. water	ml. ammonium oxalate	ml. starch	ml. Titan yellow	ml. sodium hydroxide
1	0	4.5	.5	3	1	1
2	.25	4.3	.5	3	1	1
3	.50	4.0	.5	3	1	1
4	.75	3.8	.5	3	1	1
5	1.0	3.5	.5	3	1	1
6	1.5	3.0	.5	3	1	1
7	2.5	2.0	.5	3	1	1
8	5.0	0	.5	3	1	1

have also been combined and will be referred to as bronzed.

the number of groves in which bronzing was present to the number in which bronzing was absent is also given at different levels of magnesium in the soil. Of the 25 seedy grapefruit groves containing three pounds of exchangeable magnesium, 23 (or 92 per cent) were bronzed. It will be noted that 111 out of a total of 174 of the seedy grapefruit groves that were bronzed showed less than 18 pounds of magnesium per acre-six-inches of soil. In general, the ratio of the number of groves in which bronzing was present to the number of groves in which bronzing was absent decreases with the increasing amount of magnesium in the soil as shown in Table 5. It will be observed that there is a considerable variation in the total number of groves found at the various levels of magnesium in the soil. These ratios are, therefore, less significant at those levels which are represented only by a small number of groves. For this reason, the present data are inadequate for purposes of correlations at higher magnesium levels ranging from 72 to 144 pounds of magnesium per acre.

TABLE 4

The Approximate Organic Matter Content and the Exchange Capacity of the Soils Used in This Study

Group	Approximate percentage of organic matter	Approximate exchange capacity-m. e./100 g.	No. of groves
1	Below 1 %	Below 2.0	189
2	1.0 to 1.5%	2.0 to 3.0	200
3	1.5%+	3.0+	130

The number of groves of seedy grapefruit and the two varieties of oranges in which bronzing was present as well as the number of groves in which bronzing was absent at different levels of exchangeable magnesium found in the soil, are shown in Table 5 and Fig. 1. The ratio of

TABLE 5

The relation of bronzing of seedy grapefruit, Pineapple and Valencia Oranges to the amount of magnesium in the soil.

Magnesium Pounds per acre (Mg.)	Seedy Grapefruit No. Groves In Which			Pineapple Oranges No. Groves In Which			Valencia Oranges No. Groves In Which		
	bronzing was present	bronzing was absent	Ratio*	bronzing was present	bronzing was absent	Ratio*	bronzing was present	bronzing was absent	Ratio*
3	23	2	11.5	4	0	—	5	0	—
6	27	4	6.8	3	0	—	5	1	5.0
9	30	6	5.0	6	3	2.0	12	2	6.0
12	13	3	4.3	2	2	1.0	5	3	1.7
15	18	2	9.0	10	1	10.0	11	1	11.0
18	4	4	1.0	4	0		5	1	5.0
21	9	2	4.5	2	3	0.67	2	1	2.0
24	6	3	2.0	9	2	4.5	8	3	2.7
30	16	10	1.6	3	4	0.75	8	6	1.3
36	11	20	0.55	1	4	0.25	7	4	1.7
48	11	19	0.58	7	11	0.64	10	7	1.4
60	3	10	0.30	5	2	2.5	9	3	3.0
72	2	4	0.50	2	2	1.0	2	4	0.50
84	0	5	—	1	3	0.33	3	4	0.75
96	1	4	0.25	4	2	2.0	0	3	—
120	0	1	—	1	1	1.0	3	2	1.5
144	0	1	—	0	0	—	0	1	—
Total	174	100		64	40		95	46	
Total for Varieties		274			104			141	

*Ratio — Number of groves in which bronzing was present / Number of groves in which bronzing was absent

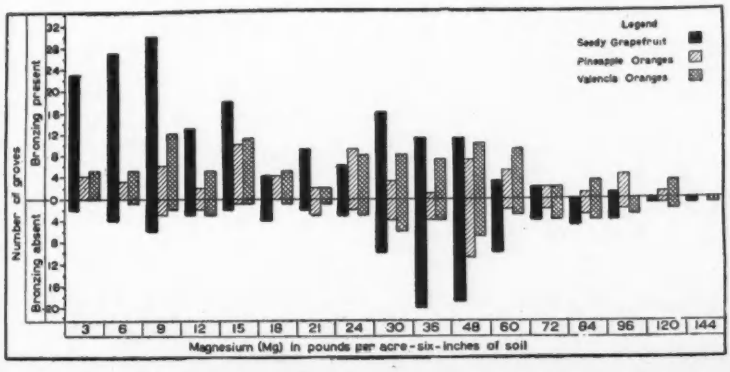

Fig. 1. The relation of bronzing of seedy grapefruit, Pineapple, and Valencia oranges to the amount of exchangeable magnesium in the soil.

In order to show more clearly the relationship between the occurence of bronzing and the amount of magnesium in the soil, the groves of each variety have been grouped in accordance with the magnesium content of the soils in the following manner: Below 30 (0-24) pounds, above 30 pounds; below 48 (0-36) pounds, and above 48 pounds of magnesium per acre-six-inches. Table 6 shows the number and the percentage of groves in which bronzing was present as well as the number of groves in which bronzing was absent within each group for the three varieties. It will be noted that 130 grapefruit groves (or 83 per cent) in which the amount of magnesium in the soil was less than 30 pounds per acre were affected with bronzing, whereas only 44 groves (or 37 per cent) were bronzed when the magnesium content found in the soil was above 30 pounds per acre. Of the total number of grapefruit groves showing less than 48 pounds of magnesium in the soil, 157 groves (or 74 per cent) were bronzed as compared to 17 groves (or only 28 per cent) that were found bronzed when the amount of magnesium was maintained above 48 pounds per acre.

Bronzing was present in 78 per cent of the Pineapple orange groves showing less than 30 pounds of magnesium in the soil and in 45 per cent of the groves with a magnesium content above 30 pounds per acre. Although bronzing was present in 70 per cent of the Pineapple orange groves showing less than 48 pounds of magnesium in the soil, 49 per cent of the groves showed bronzing with a magnesium content in the soil above 48 pounds per acre.

In the case of Valencia orange groves, 82 per cent of the groves showed bronzing when the magnesium content of the soil was less than

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Fertilizer Volume For 1938-39 May Reach 7½ Million Tons

By CHARLES J. BRAND
Executive Secretary and Treasurer,
The National Fertilizer Association
In N. Y. Journal of Commerce

• PLANT FOOD RATIOS UP — COSTS TO FARMERS LESS •

Consumption of commercial fertilizers in the United States declined moderately in 1938, following five consecutive yearly increases. The steady upward trend from 1933 through 1938 had taken consumption back to the pre-depression high point. After such an advance a decline in 1938 was not unexpected.

The decline in farm purchasing power which began in the fall of 1937, furthermore, was a clear indication that fertilizer tonnage would also fall off, as the two fluctuate together. A drop of 11 per cent occurred in farm cash income while consumption of fertilizer declined by 8 per cent. Fertilizer prices were somewhat lower in 1938 than in 1937, with farmers' expenditures for fertilizer off 11 per cent.

Comparative figures on the sales volume of the commercial fertilizer industry are given below:

	Tons
1930	8,221,000
1932	4,384,000
1937	8,195,000
1938	7,504,000

Fertilizer tonnage during the spring season has been about as large as last year, reflecting the leveling off in farm income. It now seem likely that total tonnage for the 1938-1939 fiscal year ending with June will be approximately 7,500,000 tons, the same as in the calendar year 1938.

Plant Food Content

Developments in the fertilizer industry in recent years have been favorable to the consumer from an agronomic standpoint and also from an economic standpoint. Thus while fertilizer tonnage was 6 per cent less in 1938 than it was ten years earlier, plant food consumption was greater. Since there has been an increase of more than 6 per cent in average plant food content. Fertilizers have also been improved in other ways, in addition to the rise in the plant food ratio.

Illustrating the economic changes which have taken place, farmers put out 30 per cent less cash for their fertilizer in 1938 than they had in 1928, even though tonnage was only 6 per cent less and the amount of plant food purchased was actually greater. Although the farmer got better fertilizer last year than he had gotten ten years earlier, it cost him about 25 per cent less per ton. Farm income, of course, also declined in that period, but not as much as farmers' expenditures for fertilizer.

Competition from Government agencies has continued during the past year. The Agricultural Adjustment Administration distributed directly to farmers 65,000 tons of concentrated superphosphate in 1938. This was equivalent to approximately 150,000 tons of normal superphosphate. Approximately half of this tonnage was distributed in Kentucky, making serious inroads in the business of commercial producers selling in that state.

T. V. A. Activities

Another example of the increasing Government competition with the fertilizer industry is the recent appropriation by Congress of $450,000 to be used by the T. V. A. for the construction of a commercial-size blast furnace designed to produce phosphates for fertilizers. This will add a fourth furnace to the three electric ones already in operation at T. V. A. Unless the Government plans to enter commercial production in all industries, irrespective of need, there seems to be no reason for building another concentrated superphosphate plant.

No review of the fertilizer industry during the last year would be complete without mention of the investigation of the industry started by the Department of Justice, with the aid of a large group of men from the Bureau of Investigation, and which is still in progress

A Competitive Industry

In view of this investigation and of the growing competition from the Government a summary of certain incontrovertible facts is of interest. The 900 commercial companies, with present plant and equipment, can produce more than twice as much fertilizer as this country has ever used in one year. The large number of firms, the ease with which new companies can enter the industry and the very short selling season make for keen competition. Fertilizer prices are reasonable; the Department of Agriculture reports that prices farmers pay for fertilizer are now at the prewar level, while prices they pay for all commodities are 20 per cent above prewar.

A study made in the Department of Agriculture shows that fertilizer prices have been declining in relation to the general price level for the last half century. As a result of the intense competition, fertilizer prices have been much less rigid than prices of most industrial commodities. An annual saving of $200,000,000, a result of chemical research, has been passed on to the farmer. In the last ten years, according to Federal income tax returns, net profits of fertilizer companies have amounted to only 0.67 per cent of sales. This is at the rate of about 15c for each ton of goods sold.

Wells Joins Superior As Sales Manager

G. D. Sloan, president of the Superior Fertilizer Company, of Tampa, this month announces the appointment of W. G. (Bill) Wells, Tavares, as sales manager of his company.

Mr. Wells has a background of many years experience in the horticultural and fertilizer fields in Florida. He graduated from the University of Florida in 1921, majoring in horticulture, after which he spent a year with the state experiment station in the plant pathology department.

The following two years Mr. Wells served in the horticultural department of the Exchange Supply Co., following which he was for two years county agent for Brevard county. Then between 1925 and 1935 he served as general field representative of the Gulf Fertilizer Co., during the latter part of his time acting as assistant to the sales manager.

In 1935 Mr. Wells became production manager for the Lake Region Packing Association where he increased the acreage of his associates from 700 to 3000 acres.

Mr. Wells will continue to reside in Tavares, assuming personal charge of his company's work in Lake and Orance counties, in addition to serving as sales manager in which capacity he will be available all over the state.

Heavy Shipments Oranges Continue

For the first time in history, Florida is shipping more than 1,000 cars of oranges to market during a June week—but this year more than 1,000 cars went to market every week in the month.

For the week ending June 24, there were 1,118 cars of oranges shipped out of Florida. There had been 1,109 cars shipped the week before and 1,416 cars for the week ending June 10.

Florida is experiencing an unusually long shipping season this year, and some operators expect to continue moving fruit through July. Volume of shipments are beginning to show a gradual decline, however, as the end of the shipping season approaches.

Grapefruit auction prices sagged somewhat last week, the average being $1.69 per box compared with $1.80 the week before. This is a substantial drop from the $1.93 average for the week ending June 10.

Texas grapefruit growers lost $12 per acre on the 1938-39 crop, according to testimony given at a hearing a few days ago at Austin before the Texas Railroad commission by C. W. Vandervort of Weslaco, secretary of the growers' industry committee. Mr. Vandervort told the commission that returns to Texas grapefruit growers for the season just ended were $3,029,000 compared with $4,497,000 for the 1938-39 season.

The decrease in dollars return, he said, was 32.6 percent, although the crop was 24.2 percent larger. He gave the return as $38 per acre, as against a cost of production of $50 per acre. The $12 loss per acre does not count interest on investment. Mr. Vandervort said the Texas grower received only 9.3 cents of the consumer's dollar spent for grapefruit this past season. The grapefruit crop amounted to 18,476,000 boxes, he said, or 46,790 cars. About 10 percent of the crop was dumped or fed to animals, he said, because there was not enough market to justify harvesting.

"Obviously," Mr. Vandervort told the commission, "the citrus grower cannot continue on that basis. Without a change, there will be wholesale abandonment of acreage."

Mr. Vandervort listed among growers' troubles the loss of soil fertility, insect infestation, high taxes and mounting transportation charges, all of which cause the growing of grapefruit in Texas to become increasingly precarious.

SOME RESULTS OF STUDIES ON CITRUS PRODUCTION COSTS

(Continued from page 5)

be materially reduced if heavy infestation is allowed to develop. The control of scale insects probably should be given first consideration during a low price period, in order to maintain a fairly healthy tree that can produce a fair crop at such times as economic conditions may ssem to justify stimulation of immediate fruit production. If citrus trees are neglected by lack of fertilization and tree insect control, it will take several years of additional care and expense to obtain profitable yields.

Fifth, considerable dead wood should probably be present before a great amount of expense is incurred for pruning, at the present prices of fruit. If a fair amount of nitrogenous fertilizer is used, together with partial control of tree insects, the necessary pruning expense could be reduced to a minimum, unless trees are injured by cold.

Another important phase of grove management is that of purchasing materials. The extent of purchasing power is closely associated with the volume of business. Considerable saving in the cost of materials may be made by several small growers, who are not members of a local cooperative production association, buying necessary materials cooperatively. The amount saved in buying large quantities cooperatively may mean the difference between a minus and a plus return from a grove.

Doubtless many new materials and grove practices will be offered which seemingly will peform miracles in producing earlier fruit, greater yields, better quality, and the like. Such materials and practices often fail to give the results for which they are intended. According to the records, many of these new things increase cost and decrease net returns proportionately. It would seem wise for the average grower to try these new materials or practices only in a small way, if at all, until they have been proven of economic value by the Agricultural Experiment Station or other research agencies.

The farm population of the United States on Jan. 1, 1939, was close to the largest on record, says the Bureau of Agricultural Economics. It was 32,059,000 persons. The all-time high was 32,077,000 on Jan. 1, 1910.

PARASITE TO CONTROL MEALY BUGS IS BEING TESTED BY STATION

Whether a wasp-like parasite originally from Australia will be effective in controlling mealy bugs in Florida is to be determined by tests recently begun by entomologists of the Florida Experiment Station, it has been announced.

The insect, **Leptamastix dactylopii**, has been in California for several years and the Florida station obtained live specimens of it from the California Citrus Experiment Station, Riverside, Cal.

The specimens are kept in a cage at the station in Gainesville for observation and experiment. The first mealy bugs to be parasitized by them were sent in from Sarasota County by County Agent W. E. Evans. After the mealy bugs were parasitized they were returned to Sarasota County and placed in citrus groves near Nokomis and Sarasota, according to J. R. Watson, head of the Experiment Station entomology department.

It is hoped that the new parasite will become established in Sarasota and other counties in the future and that it will prove an effective control for mealy bugs, a persistently serious pest control of citrus and other crops.

As the Experiment Station has only a small number of the parasites for its tests, it has none available for distribution, Mr. Watson explained.

RAINS BENEFIT CROPS

Heavy rains during recent weeks were beneficial to Dade County citrus, avocados, sesbania and velvet bean cover crops, forage and pastures, County Agent Charles Stefiani reports.

PERSIAN LIMES IN LEE

Stimulated by recent rains, Lee County grapefruit is sizing up nicely, according to County Agent C. P. Heuck. New plantings of Persian limes are being made in this section Mr. Heuck says.

Farmers have more than doubled their tree-planting activities since 1935, according to a report by the U. S. Forest Service. During 1938 55,359,728 seedlings for planting were distributed to farmers in 41 states and two territories under the cooperative distribution program authorized by the Clark-McNary law.

A RAPID LABORATORY METHOD FOR THE DETERMINATION OF EXCHANGEABLE MAGNESIUM IN SOILS

(Continued from page 11)

30 pounds per acre, as compared to 55 per cent of the groves which showed bronzing with a magnesium content above 30 pounds per acre. Of the total number of groves containing less than 48 pounds of magnesium in the soil, 76 per cent showed bronzing; however, bronzing was also present in 53 per cent of the groves with a magnesium content in the soil above 48 pounds per acre. In contrast to the small number of grapefruit groves found bronzed at the higher magnesium levels, a relatively high percentage of both Pineapple and Valencia orange groves showed bronzing even when the amount of magnesium in the soil was above 48 pounds per acre.

TABLE 6

The number and the percentage of groves in which bronzing was present as well as the number of groves in which bronzing was absent at different levels of magnesium in the soil.

	Seedy Grapefruit				Pineapple Oranges				Valencia Oranges			
Magnesium in pounds per acre	Below 30-1	30 and above	Below 48-2	48 and Above	Below 30	30 and above	Below 48	48 and above	Below 30	30 and above	Below 48	48 and above
Number of groves in which bronzing was present	130	44	157	17	40	24	44	20	53	42	68	27
Number of groves in which bronzing was present	26	74	56	44	11	29	19	21	12	34	22	24
Percentage of groves found bronzed	83	37	74	28	78	45	70	49	82	55	76	53

1. From 0 to 24 pounds inclusive.
2. From 0 to 36 pounds inclusive.

It will be evident from the data presented in Table 6 that the occurrence of bronzing is reduced from 83 to 37 per cent in the seedy varieties of grapefruit and approximately from 80 to 50 per cent in the two varieties of oranges when the magnesium content is maintained above 30 pounds per acre. By increasing the amount of magnesium from above 30 pounds to above 48 pounds per acre, the percentage of bronzed groves is further reduced from 37 to 28 per cent in the case of the seedy varieties of grapefruit, whereas the percentage of Pineapple and Valencia orange groves found bronzed above 30 pounds and above 48 pounds of magnesium per acre remains practically constant.

The higher percentage of bronzing found in the two varieties of oranges especially at higher levels of magnesium in the soil would not necessarily indicate that Pineapple and Valencia oranges have a higher magnesium requirement than the seedy varieties of grapefruit. The apparently higher magnesium requirement of the two varieties of oranges may be due to the difficulty encountered in estimatiing the amount of bronzing in severely bronzed orange groves which had become partially defoliated following a light frost just prior to the time the survey was made. In such cases, however, the number of shed leaves and the amount of dead wood present as a result of bronzing was taken into consideration in judging the amount and extent of bronzing. In contrast to comparatively rapid defoliation of severely bronzed orange trees the bronzed foliage on grapefruit trees remains intact for a longer period of time. Hence the amount of bronzing was probably estimated with a greater degree of accuracy in grapefruit than in orange groves and this may partially account for the better correlation obtained between the exchangeable magnesium content and the occurence of bronzing in grapefruit.

Since both dolomite and water-soluble magnesium have come into general use in citrus only during the past two years, it is quite probable that the response to recent applications of these materials in many groves had not been attained at the time the soil samples were collected which would account for the relatively higher amounts of magnesium found in some of the bronzed groves. This would tend to make the magnesium requirement appear to be higher than would normally be required if sufficient time were allowed for the maximum response. On the other hand, experiments now in progress indicate that while the use of magnesium sulfate will correct and control bronzing, this exchangeable-magnesium content is increased only slightly in acid soils (below pH 5.0) because of the difficulty in replacing the adsorbed hydrogen by magnesium applied in the form of neutral salts. Therefore, groves on acid sandy soils in which bronzing has been corrected by applications of water-soluble magnesium will show little bronzing with comparatively low amounts of exchangeable magnesium in the soil. Since the groves included in this survey were taken at random without any knowledge of the past fertilizer practice, the correlation found between the occurrence of bronzing and the amount of magnesium in the soil is surprisingly good.

It is difficult from this study to arrive at the minimum amount of magnesium necessary to control bronzing in the seedy varieties of grapefruit and in the Pineapple and Valencia oranges. The magnesium requirements of these varieties will vary, of course, with the size of the crop, the size or age of the trees, the number of trees per acre, and seasonal conditions. From the data presented for the varieties that are most susceptible to bronging, it would appear that, according to the method used here, approximately 50 pounds of magnesium per acre may be tentatively considered as an adequate supply to fulfill the magnesium requirement of citrus on most of the light sandy soils under average cropping conditions. It is hoped that more accurate information regarding the optium magnesium requirement of citrus will be obtained from the controlled experiments that are now in progress at the Citrus Experiment Station.

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(Continued on page 18)

A Review Of The 1938-39 Citrus Season

BY C. V. NOBLE
Agricultural Economist, Florida Experiment Station

The close of the 1938-39 Florida citrus season is at hand. It is only the very efficient citrus producer who can look back over the current season with any degree of satisfaction. Low unit prices have been the rule for Florida citrus, due primarily to the largest crop on record. Although national consumption of citrus has increased markedly during the past season, consumer purchasing power has been relatively low and this increase in demand for citrus could take place only at a reduction in price per unit.

As a background for a review of the Florida citrus situation it would be well to get a quick picture of the world citrus situation. This is well summarized by the Federal Bureau of Agricultural Economics in a report of April 20, 1939.

"World orange production (including mandarins and tangerines) has increased at the average rate of about 8 million boxes per year during the past decade. The United States, Brazil, Palestine, Japan, and the Union of South Africa have been the principal contributors to this expansion. Orange production in Spain, an important orange exporting country, has declined in recent years.

"The expansion of world grapefruit production also has been at a very rapid rate. In the United States the principal producing country, production during the past 10 years has more than trebled while in Palestine and the Union of South Africa the increase has been striking."

This world picture of the citrus situation is of particular interest to explain why it is increasingly difficult for this country to expand its export trade. The increased production in countries with lower production and marketing costs than prevail in the United States is ample to supply increasing foreign demands at a price that will not warrant exportation from this country.

The estimated production of oranges and tangerines in the United States for the 1938-39 season is 75,721,000 boxes. This represents an increase of 53 percent over the ten-year average production 1927-36, and approximately 2 percent over the large 1937-38 crop.

The rate of increase in production of grapefruit in the United States has been much greater than for oranges. The estimated production for 1938-39 is 40,824,000 boxes, or 143 percent more than the average production 1927-36. It is 31 percent greater than the 1937-38 crop. Texas grapefruit production has been increasing at the most rapid rate, but Florida, Arizona and California have made rapid gains.

A complete review of the 1938-39 United States citrus situation and comparison with the previous season cannot be made at this time due to complete data being unavailable, particularly grapefruit canning data from Texas. The remainder of this review will therefore be confined to the state of Florida.

The estimated production of oranges in Florida for the 1938-39 season is 27,700,000 boxes compared with a recorded production of 24,400,000 boxes in 1937-38. Out of state shipments by rail, by boat, and by motor truck and movement to Florida canneries totaled 25,202,297 boxes through May 20, 1939, compared with 21,474,918 boxes through the corresponding date in 1938. In other words, Florida had moved 91 percent of her total orange crop by May 20 this year, compared with 88 percent of her 1937-38 crop at the corresponding time in 1938.

The Florida tangerine crop also had moved in larger quantities prior to May 20 this year compared with the corresponding period last year. Ninety-one percent of the 3,200,000 box tangerine estimate for 1938-39 had moved by May 20, compared with a movement of 89 percent of the much smaller crop of 2,300,000 boxes of 1937-38 through the same date in May, 1938.

The 1938-39 grapefruit crop has created a much more serious problem than oranges and tangerines. With an estimated Florida grapefruit crop of 21,000,000 boxes, exceeding the 1937-38 crop of 14,600,000 boxes by 44 percent, only 78 percent of the present season's crop had moved to market and to canneries through May 20 compared with 89 percent movement of the 1937-38 crop at the corresponding date last year. This left approximately three times the quantity of grapefruit to be marketed during the remainder of this season as was the case last year. Florida canneries had taken more grapefruit through May 20 this year than for the entire 1937-38 season, and it is likely that this season will exceed the record 1936-37 season in canned grapefruit hearts and juice.

From the preceding discussion it will be clearly seen that the movement of Florida citrus to markets has been much heavier throughout the present season than normal. Exports have been relatively unimportant and the bulk of this increased citrus consumption has been in our domestic markets. This could take place only at reduced unit prices, for consumer purchasing power is low relative to the pre-depression period. If the average non-agricultural income of our nation for the five pre-depression years 1924-29 be taken as 100, the corresponding fiigure for 1938 is 90, or one-tenth less. For the first three months of 1939 the corresponding index has been 92, or 8 points below the pre-depression period.

With the greatly increased supply of citrus and with the demand handicapped by a below normal consumer purchasing power, the effect upon unit prices is clear. The average price per standard box for all sizes and grades of oranges sold on our ten auction markets was $2.00 for the 1938-39 season through May 19,

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Norman Tuckett, of Noling, Church & Tuckett, of Howey, gave us a recipe a few days ago that we would like to pass on to you. Obtain green bananas, not yet turning color, remove peeling, rub half of lemon over banana, and place it pot of boiling water to which has been added small piece of cod fish (smoked). Cook just as you would potatoes. In other words when they are ready to serve they will be soft when pierced by a fork. Cut in ringlets on plate and add butter. Norman says this is a very delicious plate. He should know for he spent many years in the West Indies where he says this is a common food.

GROVE SUGGESTIONS FOR AUGUST

Horticultural Department, Lyons Fertilizer Company

PEST CONTROL

Watch scale and whiteflies, particularly where bordeaux mixture was used in the spring. Oil emulsion should be used only where it is absolutely necessary. Keep a watchful eye on rust mite. They are extremely active at this time. Spray or dust with sulphur where rust mite are numerous.

FERTILIZER

Excessive rains during the past six weeks have leached out most of your nitrogen. If your trees are beginning to show signs of hunger get in touch with nearest Lyons representative, and place order for fertilizer to insure continued growth of tree and fruit for remainder of summer season. Plan to make application of regular mixed goods this fall.

PRUNING

Complete pruning as soon as possible. Be sure to remove all water sprouts. Give old trees special attention for root rot, foot rot, decayed spots, etc.

GENERAL

Remember that fires always come with the beginning of fall and discontinuance of rains. Hoe out fences as protection against fires later in the season. If cover crop has made unusual growth during past few months it will be well to get out the mowing machine.

The new bulletin by Dr. Camp and Dr. Fudge, "Some Symptoms of Citrus Mal-Nutrition in Florida," is one of the best pieces of work ever given out by the experiment station. Every grower should get this bulletin, read it carefully and keep in his file as a reference.

Pete Snyder of Lakeland has just returned from Little Rock, where he went to be under care of physician, and reports that he is feeling fine. This man is one of our strongest boosters, and each year produces fine crops of quality fruit.

Several of the bulb growers in Southwest Florida are planning to increase their acreage during the coming season. Florida not only gives the northern market vegetables during the winter months, but the most beautiful gladiolae grown anywhere in the country.

Little Bits of FUN

GOT HIS MAN

The police had photographs of the escaped convict in six positions and sent the pictures throughout the country, asking the authorities to apprehend him. Promptly came a reply from the marshall of Bent Corners, which reads as follows:

"Received the pictures of criminals. Have captured five of them and am on the trail of the sixth."

"Guilty or not guilty?" asked the judge sternly of Rastus, charged with chicken stealing.

"Not guilty, Jedge."

"What is your alibi?"

"Alley by which?"

"You heard me. Have you an alibi?"

"You mean de alley by which Ah got away, Jedge?"

"Before I heard the doctors tell
The danger of a kiss,
I had considered kissing you
The nearest thing to bliss.
But now I know biology
And sit and sigh and moan,
Six million mad bacteria—
And I thought we were alone!"

Dad—"Son, I never knew what it was to kiss a girl until I court your mother. I wonder if you will be able to say the same to your children."

Son—"I think so, Dad, but not with such a straight face as yours."

Lydia had four children and named them Eenie, Meenie, Minie and Edgar; because she didn't want no Moe.

The LYONIZER

Department

COMPILED BY THE LYONS FERTILIZER CO.

Gleanings

As a general rule we never mention any of our representatives in this department, but in this particular case we ask you to pardon us, and we will introduce to you Frank Dillinger of Sarasota. Frank is to be in charge of Southwest Florida, and we are sure that all of our customers and friends in this territory will find him a capable and energetic representative.

O. J. Harvey of the Florida Citrus Exchange is the owner of some very nice citrus property in Pinellas county. During the past season this man had one of the prettiest valencia crops in the state. We were over the groves a few days ago, and every indication at this time is that O. J. will be able to market another fine crop this season.

Due to excessive rains of the past several weeks it will probably be necessary to make application of topdresser or mixed goods to most of our grove property during the summer. The field representative in your territory has probably discussed this with you, but if he hasn't we urge you to give the grove a final check before leaving on your vacation.

John Parker, our very wide awake agent at Arcadia, suffered the misfortune of having his warehouse destroyed by fire several weeks ago. John, however, is already gettting a new building under way, and will soon have another stock of goods on hand.

Celery growers in the vicinity of Sarasota are preparing their seed beds for planting. Growers in this section had a very successful season last year, and we hope that they will have even a better one this year.

AUTHORITIES ARE UNANIMOUS in the opinion that fertilization is the most important single factor in the production of citrus fruit — fertilizaton controls in large measure not only the size of the crop but very definitely the quality, texture and flavor of the fruit produced.

Economic conditions existing in the citrus industry at the present time, however, are such that in many instances there must of necessity be two approaches to the solution of the fertilizer problem.

Where a standard grove practice has been followed for years and quality fruit has been produced at a profit, there is no question but that the same practice should be continued.

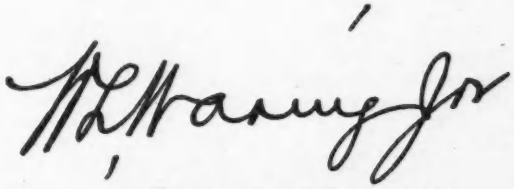
However, where conditions exist which make it essential to reduce expenditures for fertilizer, it is possible to make use of an economy fertlization plan without resorting to practices that may eventually prove harmful to your grove.

There are times during the season when economical practices can be followed without harmful effect; as a matter of fact, the use of Top Dressers and high analysis mixtures under certain conditions is desirable, but they should only be used with a full knowledge of conditions existing at the time they are applied.

Indeed, under our Lyonize Your Grove plan, we have been working along these lines for a number of years and are in position to offer growers a service that will enable them to use mixed goods, keep their groves in good condition and produce good fruit at a fertilization cost no greater than their expenditures for unsound and uneconomical practices.

We know, as a matter of actual proven test, that the results of the program outlined are effective and we are prepared to assist you in working out your grove problem so that your cost of production will be reduced to a minimum.

We invite you to consult with one of our field men, without obligation, concerning this economy fertilization program.



Preident and General Manager
The Lyons Fertilizer Company

A RAPID LABORATORY METHOD FOR THE DETERMINATION OF EXCHANGEABLE MAGNESIUM IN SOILS

(Continued from page 14)

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A REVIEW OF THE 1938-39 CITRUS SEASON

(Continued from page 15)

compared with $2.33 for the corresponding period of the 1937-38 season. Orange prices ruled much lower at the beginning of this season than in 1937-38. The margin between prices for the two seasons continued to decrease, however, and by the middle of March the 1938-39 price exceeded that of the previous season. Since that date, the present season's orange price has compared favorably with 1937-38 with higher prices ruling since that date.

The grapefruit price situation has been serious throughout the present season. The average price per standard box for all sizes and grades of grapefruit on the ten auction markets for the 1938-39 season through May 19 was $1.70 compared with $2.26 for the similar period of the 1937-38 season. Auction price fluctuations for grapefruit have been less during the current season than is normally the case, the entire season to date showing a slightly downward trend.

In closing, it is always best to forget past troubles and to look forward and to plan for better results in the future.

CALIFORNIA ESTABLISHES STANDARD BOXES

California oranges and lemons will be packed in standard boxes established by law in the future, and cannot leave the state otherwise, under terms of a state law signed a few days ago by Governor Olson.

The new law prohibits shipment of bulk loads of unsized, ungraded and uninspected oranges and lemons outside the state.

Shipment of ungraded or uninspected fruit has been outlawed in Florida for several years. Bulk fruit may be shipped from Florida if each individual fruit is marked with the grade.

The California law drafts into the agricultural code of that state the main points of voluntary agreement used among shippers of the California Fruit Growers Exchange, Mutual Orange distributors, Gold Bucklew association and several others.

The measure had the support of many major shippers in California. Citrus leaders in California said they felt the new law would have a stabilizing effect on the market for their fruit, particularly in near-by states.

Citrus Pulp Increases Milk Production

At a well attended meeting of the Associated Chambers of Commerce of Polk County monthly dinner meeting held recently at the Don Quixote restaurant in Lakeland, Dr. Wayne M. Neal of the Florida State University Experiment Station at Gainesville, spoke instructively of the use of citrus pulp as a stock food, with particular emphasis upon its importance as a food for dairy cows.

Speaking from notes, Dr. Neal outlined briefly the history of citrus pulp as a stock food and stressed the following points:

Sun-drying was the first attempted method of drying canery refuse.

F. Alex McDermott, holder of a Florida Citrus Exchange fellowship at the Mellon institute in Pittsburgh suggested in 1916 that cull fruit might be used as livestock feed.

The Florida Citrus Exchange furnished 1,000 pounds of dried grapefruit meal to John M. Scott, then animal industrialist of the Florida Agricultural Experiment Station in 1925. This was prepared by tray-drying cannery waste in a room heated by steam coils.

John M. Scott reported increased milk production as the result of the use of the dried grapefruit meal.

Citrus pulp was fed in Florida in the Jacksonville area in 1932. This pulp was material that had been prepared for pectin manufacture.

R. B. Webster and associates of Jacksonville established a plant in Tampa for the production of dried citrus pulp in 1932. This was the first commercial production of citrus pulp in Florida.

Webster's product, known as "citrose," was used in palatability, digestibility, and feeding trials in 1932-35 at the Experiment Station.

Palatability trials showed citrus pulp to be palatable to dairy cows, and that it was consumed even when offered after the regular ration had been taken.

Digestion trials showed citrus pulp to have 75 per cent of total digestible nutrients, a quantity slightly greater than in beet pulp.

Feeding trials showed that it could be given as three-quarters of the total ration when protein and vitamin requirements were supplied from other sources.

The flavor of citrus pulp-fed beef was excellent. The fat was very light in color.

The perfecting of a method of processing citrus cannery waste by W. M. Neal in 1935 has resulted in the expansion of the industry from 500 tons total production in 1932-33 to 15,000 tons during the current season.

This process, by reducing the evaporation cost, has made possible the production of citrus pulp at a price to compete with other feeds. It has improved the keeping quality of the product.

Feeding trials completed with dairy cows in 1939, to be reported by P. T. Dix Arnold and R. B. Becker, showed citrus pulp to be equivalent to beet pulp for milk production.

Five drying plants were in production during the past canning season.

The total production of citrus pulp in Florida would not replace the beet pulp importations into the state.

The commercial dairies and the family cows of Florida are the best potential market.

Control Of Red Spiders . . . And Rust Mites

J. R. WATSON, ENTOMOLOGIST, FLORIDA EXPERIMENT STATION

The control of rust mites and red spiders, both the purple mite and the 6-spotted mite, calls for the application to the trees of sulfur in some form, either the elmental sulfur itself or some of its compounds, usually lime-sulfur or wettable sulfur. It can be applied either as a dust or a spray. Which of these methods the grower will find more economical will depend much on the size of the grove, the equipment, the weather and other pests which may be controlled at the same time; in other words, a combination spray. The big advantage of dusting is the rapidity with which it can be applied. This particularly appeals to owners of large groves. It enables them to get over the grove quickly and gain control of the rust mites in the beginning of the infestation. Usually one with a power duster can dust his grove in about one-tenth of the time it takes one to spray, although this will depend much on how handy water is. Of course, with an airplane this can be reduced to a minimum.

However, if application of dust is followed within three days by a heavy rain one does not ordinarily get as good a kill as with a spray, as the dust is more easily washed off. Furthermore, one cannot dust economically if much wind is blowing.

Of the sprays, lime-sulfur is the one which has long been in use. Concentrations have varied from 1 part to 40 parts in cool weather to 1 part to 65 or even 75. The higher concentrations, of course, will be more likely to burn tender fruit.

During the last three or four years the practice has become general of putting into each 100 gallons of lime-sulfur from 5 to 10 peunds of wettable sulfur. This serves two purposes. In the first place, the addition of this extra sulfur enables the grower to use less lime-sulfur and therefore have a safer spray. By using 10 pounds of wettable sulfur per 100 gallons one can safely reduce the lime-sulfur content to as low as 1 to 65 in cool weather and one to 75 in hot weather. Wettable sulfur is also an excellent spreader, enabling one to get better coverage and coverage is one of the essentials of rust mite control. At this time of the year all parts of both leaves, small twigs and young fruit should be covered. The more thorough the kill on the leaves the less likely is the young fruit to be infected.

Growers who may be spraying their trees with bordeaux mixture as a control for melanose may take advantage of an opportunity to make a combination spray. From 5 to 10 pounds of wettable sulfur to each 100 gallons of bordeaux gives us probably the largest control of rust mites of any of the common sprays used on citrus. The bordeaux sticks to the trees and holds the sulfur, so the control is extended over a period of time.

Wettable sulfur in the proportions previously mentioned can also be added to zinc compounds, if these are being used on citrus trees.

Lime-sulfur will also kill the crawlers of scale insects and if the infestation is not too heavy may be sufficient to control scale insects; but in the case of a heavy infestation an oil spray is more effective.

The 6-spotted mite which attacks especially grapefruit has not been as abundant this season as during the two preceding ones. It congregates in large colonies on the undersides of the leaves, from which it sucks the sap, causing these spots to turn light yellow in color, if the infestation is heavy, the leaves will drop. Needless to say, the dropping of these young leaves is a serious drain on the vitality of the trees, and may result in the dropping of the fruit. The purple mite is of a reddish color and unlike the 6-spotted mite, is more apt to attack the upper side of other leaves, which instead of turning yellow in spots turn an ashen gray, losing the bright green luster of a healthy leaf. This mite can be controlled with the same spray as advised for rust mites.

World Production Of Citrus Fruit Is Expanding Rapidly

World production of citrus fruits has expanded more than most other agricultural commodities in the last 20 years, according to Gustave Burmeister in an article in the July issue of The Agricultural Situation, monthly publication of the Bureau of Agricultural Economics.

Burmeister says that production from the bloom of 1938 probably totals close to 260,000,000 boxes, of which 127,000,000 is in the United States. World production 20 years ago — in 1919 — totaled 98,000,000 boxes, of which 35,000,000 was in the United States.

Indications are, it is stated, that production "will continue to increase sharply during the next 10 years unless the standing groves suffer some unusual weather or disease damage." Many young groves are yet in fruit. The figures include the production of oranges, lemons, and grapefruit in all important producing countries except Egypt and China, for which countries no reliable information is available.

"Most striking," says Burmeister, "has been the expansion in world production of oranges — principally in the United States, Brazil, Palestine, Japan and the Union of South Africa. Production in Spain has declined in recent years. The world total for oranges from the bloom of 1937 was 185,000,000 boxes, of which more than 74,000,000 was in the United States. Production from the 1938 bloom in the United States has been indicated at more than 75,000,000 boxes."

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W. T. Pedersen, Successful Florida Grower, Visits California

From the California Citrograph

W. T. Pedersen, president-emeritus of the Waverly Growers Cooperative at Waverly, Florida, with Mrs. Pedersen and daughter, has been a visitor to California recently. Mr. Pedersen will be remembered by members of the Citrograph's Florida-Texas party which visited Florida in 1935. He not only showed them many courtesies in escorting them through the huge and very efficient packing plant at Waverly, the manager of which is Mr. Pedersen's son, W. C. Pedersen, but he acted as guide and host for the party as it visited Bok Tower, Lake Wales, Winter Haven and adjacent citrus areas.

Mr. Pedersen for a part of the time he was in southern California was the guest of J. A. Auman, of San Dimas. Mr. Pedersen and Mr. Auman were residents of the same small town in Iowa many years ago. Mr. Pedersen went to Florida to engage in citrus growing while Mr. Auman came to California, and is in the same business here.

Mr. Pedersen is a native of Denmark and has returned to his native country twice in recent years. Be-

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